National Cooperative Dairy Herd Improvement Program

RECORD BOOK

A plan for every size herd

STANDARD DHIA · OWNER SAMPLER · WEIGH-A-DAY-A-MONTH

AGRICULTURAL RESEARCH SERVICE, U. S. DEPARTMENT OF AGRICULTURE

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1,437,959 LACTATION RECORDS REPORTED IN 1964

The number of lactation records reported to the USDA for genetic appraisal and research reached an alltime high of 1,437,959 in 1964, 117,536 more than in 1963. Of these, 49.7 percent were reported on magnetic tape, 42.7 percent on punched USDA 1095 cards, and 7.6 percent on hand-recorded USDA 718 cards. Further details of lactation records as reported by individual States in 1964 are shown in Table 1.

Both the number of lactation records reported and the percentage of cows represented have increased steadily during the last 15 years. Since 1950, the number of cows enrolled in DHIA has increased nearly 100 percent, while the number of lactation records reported to the USDA has increased 205 percent. As a result, the percent of cows on test having reported records has increased from 43 to 72 percent since 1950. This more complete reporting is attributed largely to the continued development of central processing of DHIA records. A summary of the records reported since 1950 is shown below:

Year	DHIA cows enrolled (Number)	Lactation records reported to USDA (Number)	Pct. of DHIA cows represented by records reported (Percent)
1950	1,088,872	471,721	43
1955	1,333,866	636,293	48
1960	1,746,752	886,495	51
1963	2,006,534	1,320,423	66
1964	2,010,144	1,437,959	72

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CONTINUED DECREASE IN HAND-REPORTING OF LACTATION RECORDS

In 1964 only 109,182 (7.6 percent) hand-recorded lactation records were reported to the USDA. Corresponding figures for 1963, 1962, and 1961 were 138,441 (10.5 percent), 175,404 (14.5 percent), 233,468 (21.5 percent), respectively. This encouraging trend is a direct result of expanded central processing of DHIA records.

The benefits to be derived from centrally processed DHIA herd books and records have been thoroughly demonstrated during the last 10 years. It is hoped that dairymen who have not converted to the improved system will do so soon. To encourage this, the Dairy Records Committee of the American Dairy Science Association made the following recommendation in June 1964:

"The committee recommends that all DHIA records be converted to the central processing system as soon as possible. To encourage this movement, the committee recommends that July 1, 1965, be set as the target date to have all DHIA records on this system of calculation. It is recommended that no more DHIA forms for hand calculation be printed by USDA."

DHIA members who are not enrolled in central processing should be encouraged to aim at the July 1, 1965, target date for conversion. Meanwhile, the supply of DHIA forms that USDA has been providing routinely for hand-recorded records and herd books is sufficient to last, at current rates of usage, until approximately January 1, 1966.

20,563 SUMMARIES OF SIRES IN 1964

In the four quarterly sire evaluations in 1964, 20,563 summaries were made of sires in DHIA. (Individual sire records sent to the States are given by breeds in Table 2.) Seventy-five percent of the sire summaries represented non-artificially inseminated (AI) bulls averaging 13.5 daughter herdmate pairs per evaluation and a total of 203,568 daughter-records. The remaining 25 percent included AI sire summaries and 1,204,983 daughter-records averaging 238 daughter herdmate pairs per summary.

During 1964, a total of 63,806 copies of individual sire records were made available to the cooperating States.

11,385 DHIA COWS INDEXED IN 1964

A total of 11,385 DHIA cows representing the top 2 percent of registered progeny of bulls summarized in 1964, were indexed in the two evaluations performed.

112,161 LACTATION RECORDS REJECTED BY USDA IN 1964

Data processing and clerical editing procedures in 1964 resulted in the rejection of 112,161 lactation records from current and master files. These rejected records, which reflected 7.8 percent of the 1,437,959 records reported in 1964, were returned to the respective cooperating States for verification. In more than 92 percent of the rejected records, the source of discrepancy can be traced to inconsistencies in identification number (cow, sire, and dam), birth date, or calving date. These conflicts can be largely eliminated by the following:

1. Correct initial identification and reporting of the proper eartag or registration number of cow, sire, and dam.
2. Correct and consistent reporting of identification in later records of cows.
3. Correct and consistent reporting of birth dates.
4. Correct reporting of calving dates.

The frequency of DHIA lactation records rejected by the USDA in 1964 is shown by error code in Table 3.

CONSEQUENCES OF VARYING HERD LEVELS AND AREA OR REGIONAL EFFECTS ON ESTIMATES OF BREEDING VALUE OF SIRES IN AI

USDA sire summaries of AI bulls are adjusted for the following sources of variation:

1. Herd effects and time trends, by pairing only those records of daughters and herdmates within herds, years, and seasons.
2. Number of herdmates.
3. Number of daughters.
4. Genetic opportunity (level of herdmates).

Of these, the one least understood and most difficult to explain is the adjustment for level of herdmates. In general terms, this step in the USDA sire summary of AI bulls may be regarded as an adjustment for differences in opportunity or herd level of production that may exist between progeny groups. More specifically, it may be considered as an adjustment for that part of

the production of a sire's daughters that is attributed to the superiority or inferiority of their herdmates as compared to breed average.

Questions frequently raised concerning the same problem area are (1) will USDA sire summaries of AI bulls provide reliable estimates of breeding values, not just within areas and levels of herd production but throughout the United States as well, and (2) is the level of production of a summarized AI sire's daughters or herdmates, per se, a factor limiting the reliability and usefulness of his predicted average, especially if he is to be used in high producing herds? Before attempting to answer these questions, a brief explanation of the concepts underlying the adjustment for level of herdmates in USDA summaries is presented.

Research results, while somewhat variable, suggest that from 80 to 90 percent of the difference in production between herds is of nongenetic (environmental) origin. Thus, only 10 to 20 percent of the production difference between herds, or from herd to herd in herdmate averages, is assumed to be genetically determined. Assuming that (1) the genetic difference between herds or between sire-herdmate groups from herd to herd is 20 percent, (2) sires' mates and the herdmates of their daughters are genetically similar (within sire-herd groups), and (3) a sire and dam contribute equally to the genetic complex of their progeny, it follows that a sire should be credited for 10 percent of the deviation of herdmates from breed average. Therefore, the adjustment for herdmate level in USDA summaries of AI sires can be expressed as

$$ADA = DA - 0.9\ (AHMA - BA)$$

where ADA = adjusted daughter average, DA = daughter average, AHMA = adjusted herdmate average, and BA = breed average.

Henderson et al (2)[1/] and Van Vleck (7), using DHIA data from New York, and Fairchild et al (1), using DHIA data from Wisconsin, found the regression of daughters of AI bulls on herdmates to be approximately 0.9. This means that 90 percent of the difference in production between a group of herdmates and the breed average is reflected in the performance of sire's daughters. Thus for each 1,000 pounds of milk increase in herdmates, daughters of a bull may be expected to increase by approximately 900 pounds of milk.

1/ Underscored numbers in parentheses refer to References, page 7.

The method by which USDA sire summaries are adjusted for variations in herd levels of production (herdmate averages) can be simply illustrated after assuming, for example, that two sires have been extensively tested, each with equal numbers of daughters and herdmates and with identical breed-season effects. In the example of sires A and B shown below, breed average (BA) = 12,000 pounds of milk, ADA = adjusted daughter average, AHMA = adjusted herdmate average, and PA = predicted average:

Sire	DA	AHMA	DA-AHMA	ADA 1/	PA	PA-BA
A	13,000	12,000	+1,000	13,000	13,000	+1,000
B	14,000	13,000	+1,000	13,100	13,100	+1,100

1/ ADA = DA - 0.9 (AHMA - BA).

This adjustment of the daughter averages provides in the predicted average an estimate of what the progeny of each bull can be expected to average as a group in breed average herds. In the case of sire A, no adjustment is made or needed since AHMA = BA = 12,000 pounds of milk. However, 100 pounds of milk increase is credited to the predicted average of sire B. It then can be assumed that when these bulls are used at random in the population, the daughters of sire B will average 100 pounds of milk more than those of sire A. This procedure takes into consideration variation in the level of herdmate averages (herd levels) among sires and makes it possible to estimate the breeding value of bulls at all levels of herd production.

Research results indicate that there is no important genetic-environment or sire-herd interaction associated with the use of bulls in AI. Van Vleck (6) reports little, if any, genetic-environmental interaction (changes in the ranking of sires in different environments) and that sires can be evaluated in all levels of herds and with similar rank at all levels of daughters. Similar results were reported by Robertson *et al.* (5). Van Vleck (7) reports further that the common linear regression of 0.88 (0.9 used by USDA) is suitable for adjusting daughter averages for herdmate levels except when herdmates are far above or below breed average. Lytton and Legates (4) found that Holstein AI bulls ranked almost identically in Northern and Southern regions even though area differences in milk yield amounted to 2,000 to 3,000 pounds. From these and related research findings, it appears that herd levels of production and other area or regional differences are not important considerations in the reliability of USDA summaries of well-sampled AI sires.

The question remains as to the reliability of USDA summaries of specific AI bulls in predicting their performances in individual herds producing at high levels. Dairymen frequently ask "Should I use a +1,000-pound AI bull in my 16,000-pound herd if his daughters have averaged only 13,000 pounds of milk in 12,000-pound herds?" This question is answered by the apparent fact that there are no important sire-herd level interactions. Daughters of superior AI bulls will tend to be good performers regardless of the herd level in which they are used. The regression (0.9) principle previously cited, however, is again involved. The expected daughter average in an individual herd is equal to the predicted average plus 0.9 of the difference between the herd average and the breed average. For example,in a 16,000-pound herd an AI bull having a predicted average of 13,000 pounds of milk (1,000 over breed average) may be expected to sire daughters averaging 16,600 pounds of milk.

Extreme caution, however, should be exercised in attempting to predict with expected accuracy the performance of a bull in a single herd. Both environment and genetic sampling contribute heavily to variation in the performance of related individuals. Fortunately, such a practice is unnecessary. Instead, dairymen should be encouraged to use the best bulls available and to realize that <u>thoroughly sampled bulls will tend to rank similarly, regardless of the kind of environment from which they were tested or in which they will be used</u>. Under these conditions and in view of present research findings, herd or environment levels and region or area differences appear to be relatively unimportant and it becomes unnecessary to attempt to predict the specific level of transmitting ability of a bull in an individual herd.

It should be noted that additional research is needed to test certain assumptions that are made in the computation and use of the relatively new herdmate comparison. The regression value of 0.9 should be tested for accuracy, not only for herd levels of environment but also by area, region, and breed and for both milk and fat yield. Research is also needed to determine if genetic differences exist among herdmate groups from one AI sire to another and to further test the assumption that no genetic difference exists between mates of sires and the herdmates of their daughters.

It should also be noted that USDA herdmate comparisons are not completely effective in adjusting for year-to-year and region-to-region differences that may exist in breed-season averages. This results from the use by USDA of a 5-year U.S.

breed-season average in the adjustment for herdmates. This procedure will be changed at the earliest possible date, at which time the appropriate breed-region-year-season average will be used in the adjustment for herdmates.

References

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(3) Legates, J. E., F. J. Verlinden, and J. F. Kendrick. 1956. Sire by herd interaction in production traits in dairy cattle. Jour. of Dairy Sci. 39:1055.

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(5) Robertson, A., L. K. O'Connor, and J. Edwards. 1960. Progeny testing dairy bulls at different management levels. Animal Production, 2:141.

(6) Van Vleck, L. D. 1963. Genotype and environment in sire evaluation. Jour. of Dairy Sci. 46:983.

(7) Van Vleck, L. D. 1963. Regression of records on herdmate averages. Jour. of Dairy Sci. 46:846.

TABLE 1.--Production records reported to the USDA for quarterly evaluations in 1964 1/

State	DHIA cows on test 1-1-64	1964 production records					1963 production records	
		Hand recorded (718 cards)	Punched (1095 cards) 2/	Magnetic tape	Total			
	Number	Number	Number	Number	Number	Percent 3/	Number	Percent 3/
Ala--------	22,522	10	22,088	-	22,098	98.1	19,599	89.4
Alaska-----	521	-	132	-	132	25.3	90	20.9
Ariz-------	20,355	-	3,878	-	3,878	19.1	3,685	17.7
Ark--------	3,605	-	111	3,715	3,826	106.1	3,436	95.9
Calif------	318,168	6,062	10,986	-	17,048	5.4	6,661	2.0
Colo-------	12,973	-	5,803	-	5,803	44.7	5,494	45.9
Conn-------	22,493	900	200	13,688	14,788	65.7	15,954	68.2
Del--------	3,703	-	84	4,559	4,643	125.4	5,345	122.3
Fla--------	18,726	1,140	14,408	-	15,548	83.0	8,518	44.3
Ga---------	26,786	1,189	17,470	-	18,659	69.7	16,090	63.2
Hawaii-----	3,089	10	121	31	162	5.2	14	1.1
Idaho------	28,713	3,819	6,686	-	10,505	36.6	6,687	25.5
Ill--------	63,952	5,310	56,230	-	61,540	96.2	49,070	78.6
Ind--------	40,297	-	46,136	-	46,136	114.5	28,213	73.8
Iowa-------	57,438	1,044	98	58,312	59,454	103.5	48,656	83.9
Kans-------	33,098	3,575	33	25,845	29,453	89.0	23,333	80.0
Ky---------	22,000	3,207	13,231	-	16,438	74.7	13,489	64.2
La---------	5,268	451	3,444	-	3,895	73.9	3,450	66.2
Maine------	19,322	1,221	12	17,167	18,400	95.2	22,310	103.2
Md---------	45,373	6,220	140	35,729	42,089	92.8	41,166	85.3
Mass-------	22,256	586	297	21,583	22,466	100.9	24,946	107.8
Mich-------	86,263	-	82,537	-	82,537	95.7	42,301	53.7
Minn-------	125,954	20,512	45,500	28,038	94,050	74.7	76,614	61.2
Miss-------	11,334	469	8,276	-	8,745	77.2	6,545	63.8
Mo---------	24,321	5,386	292	7,312	12,990	53.4	10,124	37.2
Mont-------	4,055	1,113	398	-	1,511	37.3	1,152	28.4
Nebr-------	13,265	199	153	11,781	12,133	91.5	9,605	69.9
Nev--------	3,849	-	1,968	-	1,968	51.1	1,770	43.8
N. H-------	12,927	7	43	13,901	13,951	107.9	14,909	134.3
N. J-------	29,992	5,253	776	12,775	18,804	62.7	19,110	64.8
N. Mex-----	5,354	-	2,025	-	2,025	37.8	1,263	28.8
N. Y-------	167,490	-	130	179,635	179,765	107.3	198,294	116.6
N. C-------	42,913	-	46,747	-	46,747	108.9	43,280	101.0
N. Dak-----	6,612	343	-	5,970	6,313	95.5	5,475	91.0
Ohio-------	80,600	2,954	72,701	-	75,655	93.9	44,738	55.6
Okla-------	10,589	12	14	9,107	9,133	86.2	6,669	72.1
Oreg-------	27,215	7,275	12,301	-	19,576	71.9	18,133	64.5
Pa---------	172,807	-	751	4/102,008	4/102,759	4/59.5	150,779	87.4
P. R-------	4,688	-	-	-	-	-	2,460	47.1
R. I-------	2,518	394	69	6,297	6,760	268.5	7,021	286.7
S. C-------	19,858	-	21,634	-	21,634	108.9	19,415	99.3
S. Dak-----	6,876	462	-	6,647	7,109	103.4	3,780	48.7
Tenn-------	25,510	-	14,947	-	14,947	58.6	11,893	48.8
Tex--------	27,782	630	19,542	-	20,172	72.6	19,463	69.5
Utah-------	18,237	-	16,428	-	16,428	90.1	16,045	87.0
Vt---------	47,298	7,219	229	26,342	33,790	71.4	34,432	69.3
Va---------	61,402	8,789	48,337	-	57,126	93.0	59,926	91.7
Wash-------	50,766	11,061	14,531	-	25,592	50.4	26,158	52.8
W. Va------	9,720	2,360	-	3,455	5,815	59.8	5,384	74.7
Wis--------	117,995	-	1,102	121,431	122,533	103.8	117,066	102.3
Wyo--------	1,296	-	430	-	430	33.2	413	33.9
U. S-------	2,010,144	109,182	613,449	715,328	1,437,959	71.5	1,320,423	65.8

1/ Includes only records reported in time for use in the quarterly sire evaluations in 1964.
2/ Includes lactation records from breed associations.
3/ Records are expressed as percent of cows enrolled in DHIA. Percentages vary by State and may exceed 100 percent depending upon reporting and processing procedures in December and January of each year.
4/ Does not include lactation records on 2 reels of tape received in November but after the beginning of the final production-run in 1964.

TABLE 2.--Number of sire records summarized in 1964, by States, by breed

State	Ayrshire	Guernsey	Holstein	Jersey	Brown Swiss	Shorthorn	Red Dane	Other	Red Poll	Total
	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
Maine----------------	66	153	542	125	33	10	-	-	-	929
New Hampshire--------	115	141	630	138	40	11	-	-	-	1,075
Vermont--------------	130	225	1,128	383	95	8	-	-	-	1,969
Massachusetts--------	131	257	983	212	87	1	-	-	-	1,671
Rhode Island---------	45	55	342	50	2	-	-	-	-	494
Connecticut----------	110	353	947	161	77	-	-	-	-	1,648
New York-------------	234	515	3,176	448	161	13	4	3	-	4,554
New Jersey-----------	26	329	1,008	142	96	-	-	-	-	1,601
Pennsylvania---------	189	925	2,417	329	141	24	-	-	-	4,025
Ohio-----------------	79	409	1,305	413	159	14	-	-	-	2,379
Indiana--------------	43	375	960	227	133	19	-	1	-	1,758
Illinois-------------	88	477	1,479	235	203	29	-	-	2	2,513
Michigan-------------	44	295	1,706	227	126	18	9	-	-	2,425
Wisconsin------------	65	565	2,505	221	246	50	-	-	-	3,652
Minnesota------------	127	347	1,614	180	181	54	-	-	-	2,503
Iowa-----------------	109	320	1,551	272	246	75	-	-	1	2,574
Missouri-------------	1	219	694	170	41	25	-	-	-	1,150
North Dakota---------	4	51	346	15	51	8	-	-	1	476
South Dakota---------	37	35	469	36	57	-	-	-	1	635
Nebraska-------------	12	152	637	52	92	22	-	-	-	967
Kansas---------------	73	187	855	113	100	27	-	-	-	1,355
Delaware-------------	29	92	440	35	28	-	-	-	-	624
Maryland-------------	104	393	1,443	127	134	9	-	-	-	2,210
Virginia-------------	82	405	1,345	152	75	6	-	-	-	2,065
West Virginia--------	49	96	573	96	8	-	-	-	-	822
North Carolina-------	59	310	950	236	76	1	-	-	-	1,632
South Carolina-------	14	322	561	191	66	2	-	-	-	1,156
Georgia--------------	46	154	635	142	70	-	-	-	-	1,047
Florida--------------	26	307	309	186	40	-	-	-	-	868
Kentucky-------------	11	120	656	180	40	-	-	-	-	1,007
Tennessee------------	20	271	474	313	60	16	-	-	-	1,154
Alabama--------------	23	187	381	194	29	5	-	-	-	819
Mississippi----------	44	168	172	225	29	-	-	-	-	638
Arkansas-------------	7	71	216	60	7	17	-	-	-	378
Louisiana------------	-	184	173	103	16	-	-	-	-	476
Oklahoma-------------	37	107	413	100	34	37	-	-	-	728
Texas----------------	47	126	690	255	88	-	-	-	-	1,206
Montana--------------	5	38	129	19	30	-	-	-	-	221
Idaho----------------	10	170	483	155	37	14	-	-	-	869
Wyoming--------------	-	5	85	-	-	-	-	-	-	90
Colorado-------------	20	134	491	77	82	5	-	-	-	809
New Mexico-----------	-	94	170	37	-	-	-	-	-	301
Arizona--------------	1	122	302	35	15	-	-	-	-	475
Utah-----------------	11	109	549	80	11	-	-	-	-	760
Nevada---------------	-	14	36	70	1	-	-	-	-	121
Washington-----------	41	269	619	179	39	11	-	-	-	1,158
Oregon---------------	17	231	397	281	48	14	-	-	-	988
California-----------	6	173	453	112	10	-	-	-	-	754
Puerto Rico----------	-	-	40	-	-	-	-	-	-	40
Hawaii---------------	-	-	8	-	-	-	-	-	-	8
Alaska---------------	-	-	8	-	20	-	1	-	-	29
Total individual sire records sent to States-										63,806
Total sires summarized-----	713	3,819	12,162	2,746	863	244	10	4	2	20,563

TABLE 3.--Relative frequency of DHIA lactation record rejects in 1964

Reject code	Type of reject	Percent of all records	Percent of all rejects
D	Birth date	1.7	21.2
F	Possible twin	1.6	20.4
A	Sire number, registered	.9	12.1
Q	Calving date	.9	11.6
B	Dam number, registered	.9	10.9
H	Identification of parents	.7	9.1
M	Eartag identification	.7	8.4
R	Unusual percent test	.1	1.6
I	Cow number, registered	.1	1.3
E	Breed	.1	.9
P	Production, blank and/or alpha	.1	.7
T	Production	(1/)	.5
J	Same identification number, cow, sire, and/or dam	(1/)	.4
W	Identification conflict with Breed Associations	(1/)	.4
V	Days in milk, 3X exceeds 2X	(1/)	.2
C	Cow, sire and/or dam registration number, blank or alphabetic	(1/)	.1
G	Herd code number	(1/)	.1
Y	(USDA use only)	0	.1
O	Conflicting verified corrections, identification	0	0
S	Conflicting verified corrections, production	0	0
	Total	7.8	100.0

1/ Less than 0.05 percent.

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